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INTELLECTUAL PROPERTY LAW

To: The United States Patent and Trademark Office

Attn: Examiner Tina M. Lin

Fax No: 703-872-9326

Telephone: 703-305-1959

From: Ruy M. Garcia-Zamor

Date: July 3, 2003

Registration No.: 44,117

In the PATENT APPLICATION of:

Cryan et al.

Application No.: 09/921,113

Our File: OIC-PT005

Confirmation No.: 7077

Filed: August 1, 2001

For: GRADED INDEX FIBER, ARRAY  
AND METHOD OF MANUFACTURING

Group: 2874

Examiner: Lin, Tina

**Total Pages Including This Facsimile Cover Sheet: 17**

**LIST OF DOCUMENTS INCLUDED IN THIS FACSIMILE TRANSMISSION:**  
Amendment (15 pgs.); Fee Transmittal with Authorization to Charge Deposit Account for One extra Independent Claim (1 pg.)

**PLEASE NOTIFY RUY M. GARCIA-ZAMOR IF THIS TRANSMISSION IS NOT COMPLETE OR LEGIBLE.**

I hereby certify that this paper and the above listed documents are being facsimile transmitted to the United States Patent and Trademark Office on July 3, 2003.

  
Ruy M. Garcia-Zamor #44,117

  
Date

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# STP FEE TRANSMITTAL for FY 2003

Effective 01/01/2003. Patent fees are subject to annual revision.

Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$ 84.00)

## Complete if Known

Application Number	09/921,113
Filing Date	August 1, 2001
First Named Inventor	Cryan et al.
Examiner Name	Lin, Tina M.
Art Unit	2874
Attorney Docket No.	OIC-PT005

## METHOD OF PAYMENT (check all that apply)

 Check  Credit card  Money Order  Other  None

 Deposit Account:

Deposit Account Number  
22-0493

Deposit Account Name  
Volpe and Koenig, P.C.

The Director is authorized to: (check all that apply)

Charge fee(s) indicated below  Credit any overpayments  
charge any deficiencies

Charge any additional fee(s) during the pendency of this application

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to the above-identified deposit account.

## FEE CALCULATION

## 1. BASIC FILING FEE

Large Entity	Small Entity	Fee Code (\$)	Fee Code (\$)	Fee Description	Fee Paid
1001 750	2001 375			Utility filing fee	
1002 330	2002 165			Design filing fee	
1003 520	2003 260			Plant filing fee	
1004 750	2004 375			Reissue filing fee	
1005 160	2005 80			Provisional filing fee	
SUBTOTAL (1) (\$)		0			

## 2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

Total Claims	Extra Claims			Fee from below	Fee Paid		
	Fee from below						
	Independent Claims	Multiple Dependent	Fee				
20	20	- 20	= 0	x 0	= 0		
4	4	- 3	= 1	x 84.00	= 84.00		

Large Entity	Small Entity	Fee Code (\$)	Fee Code (\$)	Fee Description	Fee Paid
1202 18	2202 9			Claims in excess of 20	
1201 84	2201 42			Independent claims in excess of 3	
1203 280	2203 140			Multiple dependent claim, if not paid	
1204 84	2204 42			** Reissue independent claims over original patent	
1205 18	2205 9			** Reissue claims in excess of 20 and over original patent	
SUBTOTAL (2) (\$)		84.00			

\*\*or number previously paid, if greater; For Reissues, see above

## 3. ADDITIONAL FEES

Large Entity	Small Entity	Fee Code (\$)	Fee Code (\$)	Fee Description	Fee Paid
1051 130	2051 65			Surcharge - late filing fee or oath	
1052 50	2052 25			Surcharge - late provisional filing fee or cover sheet	
1053 130	1053 130			Non-English specification	
1812 2,520	1812 2,520			For filing a request for ex parte reexamination	
1804 920*	1804 920*			Requesting publication of SIR prior to Examiner action	
1805 1,840*	1805 1,840*			Requesting publication of SIR after Examiner action	
1251 110	2251 55			Extension for reply within first month	
1252 410	2252 205			Extension for reply within second month	
1253 930	2253 465			Extension for reply within third month	
1254 1,450	2254 725			Extension for reply within fourth month	
1255 1,970	2255 985			Extension for reply within fifth month	
1401 320	2401 160			Notice of Appeal	
1402 320	2402 160			Filing a brief in support of an appeal	
1403 280	2403 140			Request for oral hearing	
1451 1,510	1451 1,510			Petition to institute a public use proceeding	
1452 110	2452 55			Petition to revive - unavoidable	
1453 1,300	2453 650			Petition to revive - unintentional	
1501 1,300	2501 650			Utility issue fee (or reissue)	
1502 470	2502 235			Design issue fee	
1503 630	2503 315			Plant issue fee	
1460 130	1460 130			Petitions to the Commissioner	
1807 50	1807 50			Processing fee under 37 CFR 1.17(q)	
1806 180	1806 180			Submission of Information Disclosure Stmt	
8021 40	8021 40			Recording each patent assignment per property (times number of properties)	
1809 750	2809 375			Filing a submission after final rejection (37 CFR 1.129(a))	
1810 750	2810 375			For each additional invention to be examined (37 CFR 1.129(b))	
1801 750	2801 375			Request for Continued Examination (RCE)	
1802 900	1802 900			Request for expedited examination of a design application	

Other fee (specify) \_\_\_\_\_

\*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$ 0)

## SUBMITTED BY

(Complete if applicable)

Name (Print/Type)	Ruy M. Garcia-Zamor	Registration No. (Attorney/Agent)	44,117	Telephone	215-568-6400
Signature				Date	July 3, 2003

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PATENT



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the PATENT APPLICATION of:

Cryan et al.

Application No.: 09/921,113

Confirmation No.: 7077

Filed: August 1, 2001

For: GRADED INDEX FIBER, ARRAY AND  
METHOD OF MANUFACTURE

Group: 2874

Examiner: Lin, Tina M.

Our File: OIC-PT005

Date: July 3, 2003

VIA FACSIMILE

TO: 703-872-9326

**AMENDMENT PURSUANT TO 37 C.F.R. § 1.111**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

The following Amendment and Remarks are respectfully submitted in response to the Office Action, dated April 3, 2003 (Paper No. 9), for the above-identified application. Entry of the following Amendment and Remarks, without prejudice or disclaimer, is respectfully requested.

IN THE CLAIMS

Please amend claims 1, 10, and 14, without prejudice or disclaimer, and add new claim 20. A complete list of the claims of this application follows.

Claim 1 (Currently Amended): A graded index fiber comprising:

a drawn and fused preform comprising a plurality of low index rods, each having only a single refractive index, and at least one high index rod, having only a single refractive index, arranged in a predetermined pattern.

Claim 2 (Original): The graded index fiber of claim 1, wherein the preform includes intermediate index rods arranged in a predetermined pattern with the low index rods and the at least one high index rod.

Claim 3 (Original): The graded index fiber of claim 2, wherein the intermediate index rods have at least two different indices that are between an index of the low index rods and an index of the at least one high index rod.

Claim 4 (Original): The graded index fiber of claim 1, wherein the low index and high index rods are arranged using a statistical distribution to provide a desired refractive index distribution.

Claim 5 (Original): The graded index fiber of claim 1, wherein the low index and high index rods are glass.

Claim 6 (Original): The graded index fiber of claim 1, wherein the low index and high index rods are formed of a polymer.

Claim 7 (Original): A graded index fiber array comprised of a plurality of graded index fibers in accordance with claim 1, wherein each graded index fiber has a center located at a specified position.

Claim 8 (Original): The graded index fiber array of claim 7, wherein the array includes a plurality of graded index fibers arranged in an  $m \times n$  array.

Claim 9 (Original): The graded index fiber array of claim 8, wherein the fused GRIN fibers are located at a predetermined pitch.

Claim 10 (Currently Amended): A method of making a graded index fiber, comprising:

arranging a plurality of low index rods, each having only a single refractive

index, and a plurality of high index rods, each having only a single refractive index,  
in a predetermined pattern to form a preform;  
heating the preform of the low index and high index rods;  
drawing and fusing together the preform of low index and high index rods  
such that the relative position of the low index and high index rods is maintained.

Claim 11 (Original): The method of claim 10 further comprising:  
arranging a plurality of intermediate index rods in a predetermined pattern  
with the low index and high index rods.

Claim 12 (Original): The method of claim 11 further wherein the low index,  
intermediate index and high index rods are arranged using a statistical  
distribution to provide a desired refractive index distribution for each of the GRIN  
fibers.

Claim 13 (Original): The method of claim 10 wherein the low index and high  
index rods are arranged using a statistical distribution to provide a desired  
refractive index distribution.

Claim 14 (Currently Amended): A method of making a graded fiber index

array, comprising

arranging a plurality of low index rods, each having only a single refractive index, and a plurality of high index rods, each having only a single refractive index, in a predetermined pattern to form a preform;

heating the preform of the low index and high index rods;

drawing and fusing together the preform of low index and high index rods such that the relative position of the low index and high index rods is maintained to form a GRIN fiber;

arranging a plurality of the GRIN fibers in a preselected pattern; and

fusing the GRIN fibers together into an array.

Claim 15 (Previously Added): The graded index fiber recited in claim 1, wherein said rods are fused in direct contact with each other and being arranged in a predetermined pattern.

Claim 16 (Previously Added): The graded index fiber recited in claim 1, wherein said fiber has a graded refractive index along substantially the entire radius of the fiber.

Claim 17 (Previously Added): The graded index fiber recited in claim 1,

consisting essentially of a plurality of low index rods and at least one high index rod arranged in a predetermined pattern.

**Claim 18 (Previously Added):** The method recited in claim 10, wherein said low index rods and high index rods are fused in direct contact with one another while maintaining the predetermined pattern of the rods.

**Claim 19 (Previously Added):** The method recited in claim 14, wherein the low index rods and high index rods are drawn in direct contact with one another while maintaining the predetermined pattern of the rods.

**Claim 20 (New):** A graded index fiber comprising:  
a drawn and fused preform comprising a plurality of low index rods, each having only a single refractive index, and a plurality of high index rods, each having only a single refractive index, arranged in a predetermined pattern, the low and high index rods being arranged so that a refractive index of the graded index fiber is alternately stepped between higher and lower indices moving generally radially across the fiber.

**REMARKS**

Claims 1-20 are currently pending in this application. By the foregoing Amendment, claims 1, 10, and 14 have been amended and new claim 20 has been added.

Claims 1, 10, and 14 have been amended to recite that the low and high index fibers each have only a single refractive index. These amendments are supported by the originally filed Figures 1A-4. In each of Figures 1A, 2A, 3A, and 4, each rod is identified as being of a specific refractive index as denoted by any crosshatching thereon. That each of the rods of a particular index preferably has only a single refractive index is disclosed in the originally filed Figures 1B, 2B, and 3B. These graphs show that the individual rods each have a constant refractive index throughout.

New claim 20 is directed to a graded index fiber including a drawn and fused preform as currently recited in claim 1. Additionally, claim 20 recites that the low and high index rods are arranged so that a refractive index of the graded index fiber is alternately stepped between higher and low indices. New claim 20 is supported by: originally filed claim 1; each of the reasons recited above in connection with amended claim 1; and by the originally filed Figures 3A, 3B, and 4. Specifically, originally filed Figure 3B shows the alternate stepping between higher and lower indices when moving generally radially across the fiber shown in Figure 3A.

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No new matter is added to the application by this Amendment.

### **CLAIM REJECTIONS – 35 U.S.C. § 103**

Claims 1-5 and 7-19 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. patent 6,243,522 (“Allan et al.”). Applicant respectfully traverses this rejection as applied to the amended claims.

Referring to Applicants’ Figures 1A, 2A, and 3A, one embodiment of Applicants’ invention is directed to a graded index fiber. The graded index fiber includes a drawn and fused preform 10, 20, 30 which includes low index rods 11-15, 21, 31 that each have only a single refractive index. The preforms 10, 20, 30 include at least one high index rod 16, 22, 32 having only a single refractive index. The rods are arranged in a predetermined pattern.

To establish a *prima facie* case of obviousness, “the prior art reference (or references when combined) must teach or suggest all the claim limitations” (MPEP § 2142).

Applicants’ claim 1 recites, *inter alia*, “a drawn and fused preform comprising a plurality of low index rods, each having only a single refractive index, and at least one high index rod, having only a single refractive index ....” Applicants’ claim 10 recites, *inter alia*, “arranging a plurality of low index rods, each having only a single

refractive index, and a plurality of high index rods, each having only a single refractive index, in a predetermined pattern to form a preform...." Applicants' claim 14 recites, *inter alia*, "arranging a plurality of low index rods, each having only a single refractive index, and a plurality of high index rods, each having only a single refractive index, in a predetermined pattern to form a preform; ...."

Allan et al. are directed to a photonic crystal fiber that can be manufactured without a porous clad. Prior to Allan et al., photonic crystal fibers included a porous clad layer that contained an array of voids that served to change the effective refractive index of the clad layer to control the properties of the waveguide fiber (specification, column 1, lines 12-17). The manufacture of porous clad photonic crystal fibers proved difficult because the porosity volume and distribution had to be controlled during the drawing of the preform (specification, column 1, lines 34-36). Drawing the porous clad perform required maintaining a precise balance of pressure to maintain the equilibrium between the pressure within the pores versus the viscous forces of the material surrounding the pores under the extreme conditions experienced by the perform during drawing (specification, column 1, lines 41-46). This process was a complex manufacturing step that limited the speed of manufacture. This need for precise pressure control throughout the preform during drawing was eliminated by Allan et al. by substituting the less complex step of controlling the fabrication of the clad rod that is later used as part of the preform

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for the photonic crystal fiber (specification, column 9, liens 1-6). All of the performs described in Allan et al. require clad rods that includes a matrix material and at least one additional material each having a different refractive index (specification, column 2, lines 35-38; column, lines 24-28; and column 10, lines 40-47). All of the disclosed photonic crystal fiber preforms include clad rods that have two components that each possess different refractive indexes (column 6, lines 47-49). It is the use of clad rods having multiple refractive indexes that allows for the elimination of a porous clad layer on the photonic crystal fiber. Referring to Figures 3A and 8 of Allan et al., each of the embodiments of the Allan et al. preform incorporate cylindrical clad rods 22, 49 that includes material having at least two refractive indexes. As detailed above, this is necessary to allow the properties of the Allan et al. photonic crystal fibers (such as, mode field diameter or total dispersion) to be adjusted without using a porous cladding. There is no disclosure, teaching, or suggestion in Allan et al. of using a preform formed of clad rods only having a single refractive index. *To the contrary, Allan et al., specifically teaches the use of clad rods having at least two materials with different refractive indexes to allow the regulation of photonic crystal fiber properties without using a porous cladding.*

Applicants respectfully submit that Allan et al. fail to disclose, teach, or suggest Applicants' elements, recited in claims 1, 10, and 14, of a drawn and fused

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perform of low and high refractive index rods each having only a single refractive index. As detailed above, Allan et al. specifically teaches the use of clad rods having multiple refractive indexes as a method of eliminating the complex drawing process that is necessary when manufacturing photonic crystal fibers having a porous clad layer. Accordingly, Applicants respectfully submit that Allan et al. fail to disclose, teach, or suggest each of the elements of Applicants' claims 1, 10, and 14.

To properly combine references to form a section 103 rejection:

The proposed modification cannot render the prior art unsatisfactory for its intended purpose. . . . The proposed modification cannot change the principle of operation of a reference. If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie obvious*.

MPEP § 2143.01 (emphasis added).

Applicants respectfully submit that modifying Allan et al. to form Applicants' claimed invention renders Allan et al. unsatisfactory for its intended purpose. As detailed above, Allan et al. eliminate the complex problem of maintaining critical pressures during the drawing process of photonic crystal fibers necessary when using a porous cladding by using a preform that includes clad rods having multiple refractive indexes. The Allan et al. clad rods having multiple refractive indexes are

necessary to allow the properties of the resulting photonic crystal fiber to be controlled. Modifying Allan et al. to use clad rods only having a single refractive index is completely opposite to the specific teachings of Allan et al. and would cause the Allan et al. photonic crystal fiber to have unsatisfactory waveguide properties. Furthermore, modifying Allan et al. to form Applicants' claimed invention would change the explicit principle of operation of Allan et al. which is to use clad rods having multiple refractive indexes to eliminate the need to control pressures during the preform drawing step to manufacture photonic crystal fibers having desired waveguide properties. Accordingly, Applicants respectfully submit that Allan et al. cannot properly be used as part of a Section 103 rejection for Applicants' claims as modifying Allan et al. to form Applicants' claimed invention results in Allan et al. being unsatisfactory for its intended purpose and changes the principle of operation of Allan et al. Accordingly, Applicants respectfully submit that the teachings of Allan et al. are not sufficient to render the current claims *prima facie* obvious.

Applicants respectfully submit that claims 1, 10, and 14 are patentable over Allan et al because: (1) Allan et al. fail to disclose, teach, or suggest each of Applicants' claimed elements; (2) modifying Allan et al. to form Applicants' claimed invention would result in Allan et al. being unsatisfactory for its intended purpose; (3) modifying Allan et al. to form Applicants' claimed invention would require changing of the principle of operation of Allan et al.; and (4) the teachings of Allan

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et al. are not sufficient to render the current claims *prima facie* obvious. Additionally, Applicants respectfully submit that claims 2-5, 7-9, 11-13, and 15-19 each depend, direct or indirectly, on one claims of 1, 10, and 14 and, accordingly, are also patentable over Allan et al.

Applicants respectfully request the Examiner reconsider and withdraw this Section 103 rejection of claims 1-5 and 7-19.

Claim 6 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Allan et al. in view of U.S. patent 6,091,872 ("Katoot"). Essentially, this rejection relies on Allan et al. to teach each of the elements of claim 1 and only relies on Katoot to teach the use of low and high index rods formed of a polymer. As detailed above, Allan et al.: does not disclose each of the elements of Applicants' claim 1; cannot be modified to form Applicants' claimed invention without rendering Allan et al. unsatisfactory for its intended purpose; and cannot be modified to form Applicants' claimed invention without changing the principle of operation of Allan et al. Katoot does not remedy any of the above deficiencies in Allan et al. Accordingly, Applicants respectfully submit that claim 6 is patentable over the combination of Allan et al. and Katoot for each of the reasons recited above in connection with claim 1.

Applicants respectfully request that the Examiner reconsider and withdraw this section 103 rejection of claim 6.

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### **NEW CLAIM**

New claim 20 has been added to this application. As detailed above, the elements recited in claim 20 are supported by the originally filed application. Applicants respectfully submit that new claim 20 is patentable for each of the reasons recited above in connection with amended claim 1.

### **INVITATION**

If any additional matters need to be addressed to place this application in condition for allowance, the Examiner is respectfully invited to contact the undersigned, by telephone, at the Examiner's convenience.

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## CONCLUSION

In view of the foregoing Amendment and Remarks, Applicants respectfully submit that the present application, including claims 1-20, is in condition for allowance and a notice to that effect is respectfully solicited.

Respectfully submitted,

Cryan et al.

By   
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**INTELLECTUAL PROPERTY LAW**

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**To: The United States Patent and Trademark Office**

**Attn:** Examiner Tina M. Lin      **Fax No:** 703-872-9326  
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**From:** Ruy M. Garcia-Zamor      **Date:** July 3, 2003  
**Registration No.:** 44,117

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